

# Composites

## Manufacturing Technologies

Polymer composite materials are composed of fibers in an organic matrix and can be useful in applications that require a high strength-to-weight ratio. Sandia's Manufacturing Science and Technology staff will work with you from part design, through mold and tooling design, and on through fabrication. The department is capable of fabricating small and large complex parts and will help you choose the most economical technique for your composite needs.

### Capabilities

The Center has a comprehensive program on the mechanical engineering design, tooling and fixturing, lay-out, complete processing of the composite structure, and technology transfer of composite structures for a variety of military and non-military applications.

- Composite Fabrication: Fabrication of polymer composites using hand lay-up, filament winding, captured rubber, closed die, and vacuum bagging techniques
- Tooling: Design and development of the tooling used on your project. Experience with the use of stereolithography for tooling



*Composite prepreg lay-up directly from stereolithography*



*3 foot diameter cyanate ester/fiberglass laminated antenna*

- Cleaning/Surface Preparation: Various surface preparation techniques are used prior to assembling composite subcomponents, such as solvent cleaning (both traditional and alternative), plasma cleaning, sandblasting, chemical etching, and priming
- In-situ process monitoring and data acquisition
- Comprehensive mechanical testing of composite structures



*Composite prototype fabrication*

### **Resources**

- Abrasive blasters/vapor hydrohone
- Microprocessor controlled ovens
- Autoclave: 4 ft. diameter x 8 ft. long
- UV curing
- Walk-in oven: 6 ft. x 6 ft. x 9 ft.
- Dry wall (walk-in hood): 9 ft. x 9 ft. x 11 ft.
- Vacuum casting equipment
- Plasma cleaner
- Vacuum lamination press
- Filament winder, 5-axis, computer controlled
- Thermoformer: 5 ft. x 5 ft.
- Class 100 clean bench
- Environmental temperature cycling with optional humidity control
- Walk-in refrigerator/freezer
- Ultrasonic cleaner
- Presses: 50 ton, 30 ton, 1000 lbs
- Rubber Mill

### **Accomplishments**

- Developed a paperless process for the fabrication of graphite/epoxy composite structures used on flight hardware. The process utilized stereolithographically pro-

duced tooling and low temperature composite prepregs. Customer realized significant cost and time savings.

- Teamed with Air Worthiness Assurance experts to determine minimum detection limits of flaws within composite structures. Simulated and tested for voids, corrosion, and delamination. Also developed composite doubler repair technology for structural repair of aircraft. Technology was transferred to a major commercial air carrier.



*Cured composite structure*

- Designed and prototyped fully integrated graphite/epoxy communication modules for nuclear weapons code and key management systems.
- Teamed with state Universities to design and fabricate composite cockpit for solar car. Established and implemented structural improvements.

### **Contact:**

*Ernest Correa, (505) 845-9745  
eacorre@sandia.gov*

*Mathew Donnelly, (505) 845-9746  
mwdonne@sandia.gov*